

REMARKS

A Revocation of the previous agent of record and appointment of the practitioners associated with Customer No. 26744 was filed on March 25, 2009.

This response is a reply to the Office Action mailed September 30, 2008 which was responsive to the communications filed by the applicant on August 2, 2005. A Request for a three (3) month extension of time has been submitted under separate cover on today's date.

There are 62 claims pending in the application, of which claims 1 to 36 were originally presented. Applicant has amended claims 1, 26, 27, 28, 29, 30 and 34.

Applicant has cancelled no claims.

Applicant has added new claims 37 to 62:

- claims 37-43 being the introduction of the allowable subject matter of claim 9 into claim 1 and dependent claims thereof; and
- claims 44 to 62 being the introduction of the allowable subject matter of claim 23 into claim 1 and dependent claims thereof.

Claims 1, 26, 27, 28, 29, 34, 37, and 44 are independent.

Claim Rejections 35 USC § 103(a)

Claims 1-4, 6, 10, 26, 27, 29-33 are rejected to under 35 U.S.C. § 103(a) as being unpatentable over Schilling et al (US 6,757,322)(hereinafter Schilling) in view of Onggosanusi et al (US 7,133,459)(hereinafter Onggosanusi).

Schilling teaches a method of transmitting a plurality of spread-spectrum communication signals with fading in the communication path for Code Division Multiple Access (CDMA) wherein the transmitters and receivers have multiple inputs and multiple outputs to improve performance, so-called MIMO technology. As taught by Schilling the MIMO system comprises a plurality of receiving antennae which receive the time and space multiplexed spread-spectrum signals

transmitted from the array of transmitters, and also receive a plurality of fading spread-spectrum signals. Each antenna is filtered using matched filters which have impulse responses matched to the chip-sequence signal applied to one transmitter. These filtered signals are then fed forward to a time (RAKE) and space diversity combiner, thereby generating a detected spread-spectrum signal and multi-path spread-spectrum signals. Through measurement of the symbol amplitudes and applying erasure decoding an improvement in performance of the detection circuit can be achieved.

Whilst Schilling teaches multiple modulation formats such as QPSK, BPSK, binary encoding etc in all scenarios the data to be transmitted from each individual transmitter is encoded with a pseudo-random codes thereby generating the spread-spectrum sequences, and as such the transmitter encoding being that of CDMA. Further at the receivers the matching filters employ chip-sequence signals, which are in fact the pseudo-random codes in the spreading sequence, and thereby again CDMA.

Onggosanusi similarly teaches a variant to CDMA wherein the symbols are encoded with space-time transmit diversity such that each symbol is transmitted from a pair of antennas wherein the data to each antenna of the pair is one of the pair wise rotations in two dimensional complex space of the symbol. The teachings of Onggosanusi in respect of the spreader code, i.e. pseudo-random code, are that the same one is employed on all transmitters at the same time. Multiple signals are therefore transmitted from pairs of antennas simultaneously with the same spreader code.

As taught by Schilling the RAKE and space combiners (shown in his Figure 3, modules 161, 162, 163, 164) each provide for a filtering of the received signals from a matched filter set (shown in his Figure 3, modules 24, 34, 44, 54) so as to undo the action of the time-domain spreading, performed at his MIMO transmitter by chip sequence generator and multipliers (see Figure 1, modules 31 and 23, 33, 43, 53). Accordingly the RAKE and space combiners perform in the time-domain in order to de-spread the CDMA signals received at the MIMO receiver.

Referring to independent claims 1, 26 and 27 as amended Applicant recites “a space matched filter connected to said plurality of receive interfaces and operative to i) assemble the received data elements into sets of received data elements data elements; and ii) jointly process each set of received data elements; wherein (i) and (ii) are performed absent processing of the received data elements in the time domain.” Accordingly Schilling does not teach to the use of a space matched filter absent processing in the time domain. Rather Schilling specifically teaches to the RAKE and space combiner “as well as a single RAKE / maximal ratio combiner to combine all time and space signals” (col. lines 29-32). As such Applicant contends that Schilling does not teach the invention as taught.

Further, as the Examiner noted Schilling does not disclose “each channel data element being representative of a portion of the communications channel between an associated one of the transmit elements and said plurality of receive interfaces” and accordingly has cited Onggosanusi to introduce this missing element. As noted supra Onggosanusi also teaches to a CDMA based system and a serial to parallel converter which the Examiner has cited to interpret the parallel data as set of data.

Onggosanusi teaches that the serial to parallel converter operates wherein “block interleaved, and mapped to a block of symbols $s_1(n)$, $s_2(n)$, $s_1(n+1)$, $s_2(n+1)$, $s_1(n+2)$, $s_2(n+2)$ ” are present and the “serial-to-parallel converter sends the stream $s_1(n)$, $s_1(n+1)$, $s_1(n+2)$ to the upper STTD encoder and $s_2(n)$, $s_2(n+1)$, $s_2(n+2)$ to the lower STTD encoder”. As such the serial to parallel encoder of Onggosanusi is a time division demultiplexer, which by its very nature cannot perform actions “absent processing of the received data elements in the time domain” as recited in amended claims 1, 26 and 27.

Accordingly the Applicant traverses the rejection to independent claims 1, 26 and 27 on the grounds that neither Schilling nor Onggosanusi teach to the matter recited in the claims as amended and that the combination of the two thereof, even where motivation to combine could be shown, do not teach to the recited inventions. As such Applicant respectfully requests that the rejection of claims 1, 26 and 27 under 35 U.S.C. 103(a) be withdrawn.

In respect of dependent claim 2 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 2 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 2. Applicant respectfully requests that the rejection to claim 2 under 35 U.S.C. 103(a) be withdrawn.

Referring to claim 3 the Applicant recites “operative to perform a linear combination of the received data elements.” As noted supra Schilling does not linearly combine but exploits a RAKE / maximal ratio combiner therein employing time domain re-arrangement of elements and maximal ratio combination. Further Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 3 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 3. Applicant respectfully requests that the rejection to claim 3 under 35 U.S.C. 103(a) be withdrawn..

In respect of dependent claim 4 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 4 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 4. Applicant respectfully requests that the rejection to claim 4 under 35 U.S.C. 103(a) be withdrawn.

Referring to claim 6 Applicant notes Examiner has cited Onggosanusi for teaching to the iterative detector with reference to the specification (col. 5 lines 64-67 and col. 6 lines 6-13). Rather Applicant notes Onggosanusi teaches to the maximum likelihood detector being as other than an iterative detector with “iterative detectors are not applicable” (col. 5 lines 53-54).

Accordingly Applicant traverses the rejection raised in respect of claim 6 on the grounds that it is not taught by Onggosanusi. Further in respect of dependent claim 6 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 6 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 6. Applicant respectfully requests that the rejection to claim 6 under 35 U.S.C. 103(a) be withdrawn.

In respect of dependent claim 10 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 10 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 10. Applicant respectfully requests that the rejection to claim 10 under 35 U.S.C. 103(a) be withdrawn.

Referring to independent claim 29 Applicant notes that as discussed supra in respect of independent claims 1, 26, and 27 as amended Schilling and Onggosanusi both teach to the use of time (RAKE) domain processing of the received signals within a MIMO system. Applicant recites “a space matched filter connected to the receive interfaces to jointly process a vector formed from received data elements absent any processing in the time domain.” Further in respect of independent claim 29 Applicant notes that the claim includes matter neither taught nor taught towards in either Schilling or Onggosanusi. Applicant also respectfully re-iterates the arguments presented above with respect to independent claims 1, 26, and 27 and applies them to independent claim 29. Applicant respectfully requests that the rejection to claim 29 under 35 U.S.C. 103(a) be withdrawn.

In respect of claim 30 Schilling states “the number of transmit antennas is not the same as the

number of receive antennas” (col. 6 lines 14-15) despite teaching in Figs. 1 and 3 to the number of transmit antennas being equal to the number of receive antennas. There is no specific teaching to the recited limitation of “the number of receive interfaces is at least as great as the number of transmit interfaces.” Further in respect of dependent claim 30 Applicant notes that the claim is dependent upon independent claim 29 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 30 includes all the limitations of claim 29, Applicant respectfully re-iterates the arguments presented above with respect to claim 29, and applies them to claim 30. Applicant respectfully requests that the rejection to claim 30 under 35 U.S.C. 103(a) be withdrawn.

In respect of claim 31 Schilling states “the number of transmit antennas is not the same as the number of receive antennas” (col. 6 lines 14-15) despite teaching in Figs. 1 and 3 to the number of transmit antennas being equal to the number of receive antennas. There is no specific teaching to the recited limitation of “the number of receive interfaces is less than the number of transmit interfaces.” Further in respect of dependent claim 31 Applicant notes that the claim is dependent upon independent claim 29 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 30 includes all the limitations of claim 29, Applicant respectfully re-iterates the arguments presented above with respect to claim 29, and applies them to claim 30. Applicant respectfully requests that the rejection to claim 30 under 35 U.S.C. 103(a) be withdrawn.

In respect of dependent claim 33 Applicant notes that the claim is dependent upon independent claim 29 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claim 33 includes all the limitations of claim 29, Applicant respectfully re-iterates the arguments presented above with respect to claim 29, and applies them to claim 33. Applicant respectfully requests that the rejection to claim 33 under 35 U.S.C. 103(a) be withdrawn.

Claims 5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schilling and Onggosanusi, as applied to claims 1 and 6 above, and further in view of Hochwald et al (US 7,236,536)(hereinafter Hochwald).

In respect of dependent claims 5 and 7 Applicant notes that these are both dependent upon independent claim 1 and include all the limitations of claim 1 and includes matter neither taught nor taught towards in Schilling, Onggosanusi or Hochwald. Further Hochwald does not teach to the space matched filter absent time domain processing as recited by claim 1. Accordingly Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claims 5 and 7. Applicant respectfully requests that the rejections to claims 5 and 7 under 35 U.S.C. 103(a) be withdrawn.

Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schilling, Onggosanusi, and Hochwald, as applied to claim 7 above, and further in view of Gorokhov et al (US 7,397,826)(hereinafter Gorokhov).

Referring to claim 8 Applicant notes the Examiners comments that neither the combination of Schilling, Onggosanusi and Hochwald teach the recited limitation. As noted by the Examiner Gorokhov discloses that a soft decision process generates metrics of reliability that is mathematically based upon the posteriori probabilities of the bit being a “1” or a “0”. However Gorokhov does not teach to the missing element in Schilling, Onggosanusi, and Hochwald in respect of the receive channel processing being absent time domain processing as recited by the Applicant as Gorokhov addresses the improvement of CDMA MIMO systems.

Further in respect of dependent claim 8 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi, Hochwald or Gorokhov. As claim 8 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 8. Applicant respectfully requests that the rejection to claim 8

under 35 U.S.C. 103(a) be withdrawn.

Claims 11-22, 24 and 25 are rejected under 35 U.S.C 103(a) as being unpatentable over Schilling and Onggosanusi, and further in view of Ten Brink et al (EP 0998045)(hereinafter Brink).

In respect of claim 11 Applicant notes that Brink teaches to the mapping / de-mapping several bits of received data to a symbol. Applicant further notes that Brink does not teach to the spatial combining of multiple received signals within a MIMO system. Accordingly whilst Brink teaches to a de-mapper the overall combination of Schilling, Onggosanusi and Brink does not teach the recited invention of the Applicant with respect to the processing being absent any time domain processing. Additionally Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi or Brink. As claim 11 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 11. Applicant respectfully requests that the rejection to claim 11 under 35 U.S.C. 103(a) be withdrawn.

Referring to claims 12 through 17 Applicant notes that all recited inventions relate to a de-mapper and note the Examiners reference to Brink to introduce the missing element of a de-mapper from the alleged obvious combination of Schilling and Onggosanusi. As noted supra Schilling and Onggosanusi do not teach the recited invention of independent claim 1 from which dependent claims 12 through 17 depend. Additionally Applicant notes that these claims are dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi or Brink. As such these claims include all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claims 12 through 17. Applicant respectfully requests that the rejections to claim 12 through 17 under 35 U.S.C. 103(a) be withdrawn.

Referring to dependent claim 18 Applicant notes the Examiners construction of the multiplexer to FEC decoder (Schilling Fig. 3) and FEC decoder to de-mapper (Brink Fig. 4). Applicant notes that Brink was published nearly two years before either Schilling or Onggosanusi as a means to improve the performance of a communications system without addressing or discussing any spatial combination of signals within a MIMO system. Specifically Brink teaches to the introduction of error codes and mapping transmission symbols to multilevel signals. Accordingly the Applicant contends that it is not obvious to combine the teachings of Brink with Schilling and Onggosanusi to provide mapping at the transmitter and de-mapping at the receiver in combination with RAKE / maximum likelihood combiners as Brink teaches to de-mapping at the receiver with subsequent channel de-interleaving in the time domain.

Additionally Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi, or Brink. As claim 18 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 18. Applicant respectfully requests that the rejection to claim 18 under 35 U.S.C. 103(a) be withdrawn

In respect of claims 19 and 20 Applicant notes that recited inventions relate to the decoder in combination with the de-mapper and note the Examiners reference to Brink to introduce the missing elements from the alleged obvious combination of Schilling and Onggosanusi. Additionally Applicant notes that the claims are dependent upon independent claim 1 which includes matter neither taught nor taught towards in either Schilling or Onggosanusi. As claims 19 and 20 include all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claims 19 and 20. Applicant respectfully requests that the rejections to claims 19 and 20 under 35 U.S.C. 103(a) be withdrawn

Referring to dependent claim 21 Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi or Brink. As claim 21 includes all the limitations of claim 1, Applicant respectfully re-iterates the

arguments presented above with respect to claim 1, and applies them to claim 21. Applicant respectfully requests that the rejection to claim 21 under 35 U.S.C. 103(a) be withdrawn

Referring to dependent claim 22 Applicant notes the Examiners identification of channel estimation within Onggosanusi in respect of providing said data to the matched filter. Applicant notes that the claim is dependent upon independent claim 1 which includes matter neither taught nor taught towards in Schilling, Onggosanusi or Brink. As claim 22 includes all the limitations of claim 1, Applicant respectfully re-iterates the arguments presented above with respect to claim 1, and applies them to claim 22. Applicant respectfully requests that the rejection to claim 22 under 35 U.S.C. 103(a) be withdrawn

Claim 28 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Schilling and Onggosanusi, as applied to claim 1 above, and further in view of Langberg et al (US 5,852,630)(hereinafter Langberg).

In respect of independent claim 28 Applicant notes that Examiner has cited Langberg as providing the computer readable storage medium for storing the program element providing a software implementation of the space matched filter. Said element being the element missing from Schilling and Onggosanusi combined to provide obviousness of the recited invention. However, as noted supra in respect of other independent claims Schilling and Onggosanusi teach to the use of time and space domain filtering and transmission diversity. Applicant recites that the space matched filter “jointly process each array of received data elements, wherein jointly processing is absent any processing in the time domain.”

As noted supra this recited limitation is not taught by Schilling or Onggosanusi nor any combination thereof. Further their combination with Langberg does not teach this recited limitation. Additionally Applicant notes that the claim includes matter neither taught nor taught towards in Schilling, Onggosanusi or Langberg as noted supra in respect of being absent any processing in the time domain. Applicant respectfully re-iterates the arguments presented above

with respect to independent claim 1, and applies them to claim 28. Applicant respectfully requests that the rejection to claim 28 under 35 U.S.C. 103(a) be withdrawn

Claim 34-36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Schilling and Onggosanusi, as applied to claim 1 above, and further in view of Forsythe et al (US 6,745,000)(hereinafter Forsythe).

Referring to independent claim 34 Applicant recites a “system for estimating data transmitted from each of a plurality of users across a communications channel, the data transmitted from the k^{th} user being transmitted via n_k respective transmit elements, comprising: a space matched filter connected to said plurality of receive interfaces and operative to i) assemble the received data elements absent processing in the time domain; and ii) for each of the plurality of users, jointly process each set of received data elements absent processing in the time domain.”

As noted supra the individual and combined prior art of Schilling and Onggosanusi do not teach to the recited invention. Applicant notes that the Examiner has introduced the prior art of Forsythe to introduce the missing system estimating data to each of a plurality of users and jointly process the space matched filtering for each user. However, Forsythe does not teach to the recited limitation of the space matched filtering in respect to it being “performed absent processing in the time domain.” Rather Forsythe teaches to the received signals from the multiple receivers being processed by a space-time adaptive beamformer 60 after being coupled from tapped delay lines, which by their nature perform processing in the time domain

Hence whilst Forsythe teaches to multi channel multi user detection the combination with Schilling and Onggosanusi the overall combination does not teach to the recited invention. Applicant respectfully re-iterates the arguments presented above with respect to independent claims 1, 26 and 27 and applies them to independent claim 34. Applicant respectfully requests that the rejection to claim 34 under 35 U.S.C. 103(a) be withdrawn

Regarding dependent claims 35 and 36 Applicant notes that these claims are dependent upon independent claim 34 which includes matter neither taught nor taught towards in Schilling, Onggosanusi or Forsythe. As claims 35 and 36 include all the limitations of claim 34, Applicant respectfully re-iterates the arguments presented above with respect to claim 34, and applies them to claims 35 and 36. Applicant respectfully requests that the rejection to claims 35 and 36 under 35 U.S.C. 103(a) be withdrawn

Allowable Subject Matter

Claims 9 and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

The Applicant thanks the Examiner for the detailed and thorough analysis of the application and notes that the Examiner has indicated the recited limitations of independent claims 9 and 23 would be allowable if rewritten to independent form with all required intermediate limitations.

Applicant has added new claims introducing said allowed subject matter into independent base claim 1 with the necessary intermediate dependent claims.

Accordingly independent claim 37 comprises original independent claim 1 with the allowable subject matter of claim 9 together with the required intermediate limitations of claims 6, 7 and 8. Claims 38 to 43 respectively are therefore original dependent claims 2 – 5, 21 and 22 in dependent form in respective order from the new independent claim 37.

Similarly independent claim 44 comprises original independent claim 1 with the allowable subject matter of claim 23 together with the required intermediate limitations of claims 10 and 18. Claims 45 to 62 respectively are therefore the original dependent claims 2 – 5, 11-17, 19-22, 24 and 25 in dependent form in respective order from the new independent claim 44.

Application Serial No. 10/544,108

Amendment Dated: March 30, 2009

Reply to Office Action dated: September 30, 2008

Applicant believes and submits that the Application is now in condition for allowance, and earnestly solicits action to that end.

Respectfully submitted,
MYSORE, Naveen et al

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